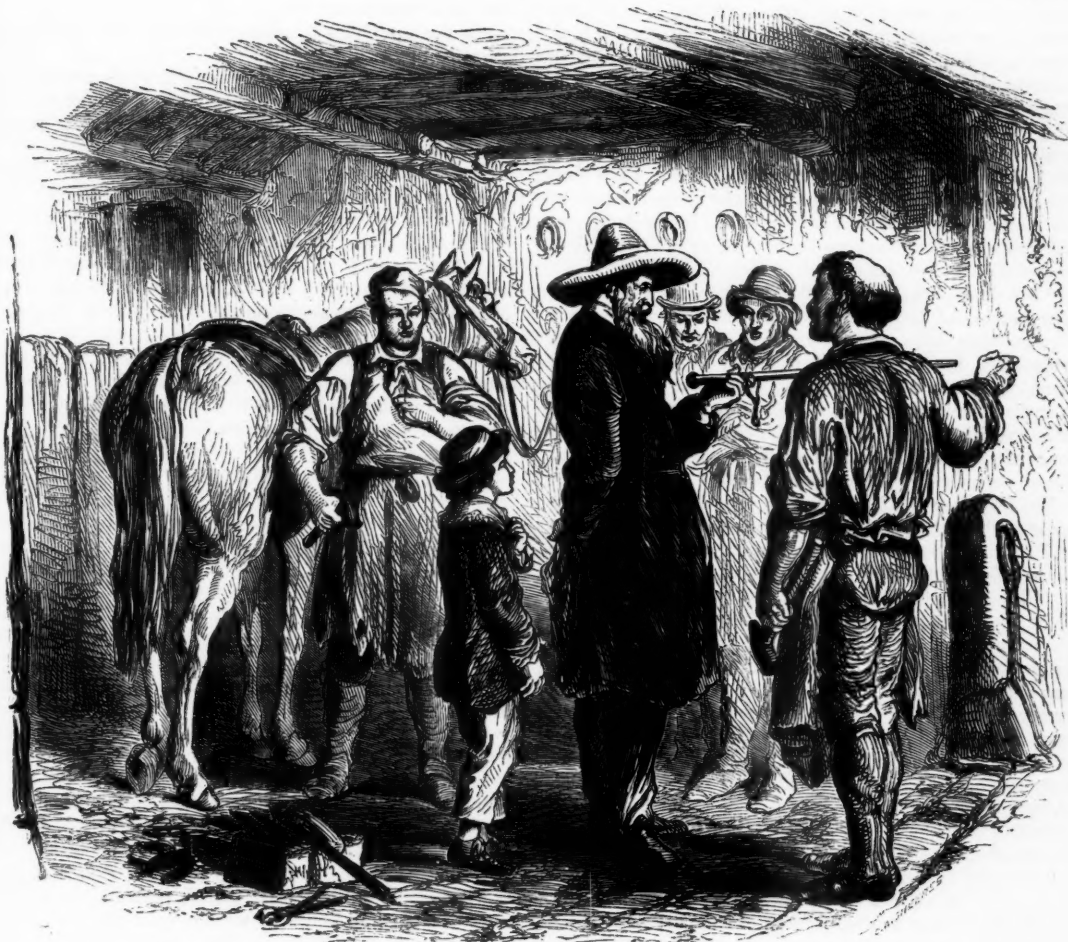


THE LEISURE HOUR

A FAMILY JOURNAL OF INSTRUCTION AND RECREATION.

BEHOLD IN THESE WHAT LEISURE HOURS DEMAND,—AMUSEMENT AND TRUE KNOWLEDGE HAND IN HAND."—*Cosper*.



INQUIRIES AT THE BLACKSMITH'S SHED.

GEORGE BURLEY;

HIS HISTORY, EXPERIENCES, AND OBSERVATIONS.

BY G. E. SARGENT, AUTHOR OF "ADVENTURES OF A CITY ARAB."

CHAPTER XI.—WANTED, AN HEIR.

IN the foregone chapters I have, for the better elucidation of my story, found it necessary to narrate some events which transpired in the lives of other persons many years before I was born. It will be presently seen how intimate a connection there is between those events and what I have further to write. I may say, also, that, though I have headed these papers with my

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own insignificant name, it will be observed that no small portion of them will be occupied with the sayings and doings of the various people with whom, in the days of my childhood, boyhood, and youth, I was brought into contact. With this explanation, if explanation be required, I resume my history.

I have said that Mr. Falconer's principal object in his return to London was to seek out the faithless pair who, thirty years before, had so deeply and treacherously injured him—not for the purpose, be sure, of taking a late and tardy revenge upon the false friend and fickle dame, nor even to satisfy a vain curiosity, but, judging

from what really did afterwards take place, that he might condone the past offence by showering benefits on the offenders.

Anger—however righteous and justifiable—must be very deep and implacable to last thirty years; and, as Mr. Falconer was essentially a generous man, I am persuaded that his resentment had long since faded away. Still, in the earlier years of his voluntary banishment his mind had been too acutely sensitive to the wrong he had suffered to permit him to make any inquiries respecting Frank Tozer and his wife, while a kind and considerate reticence had been maintained by such of his friends at home as might have informed him of their fate. It is not wonderful, therefore, that in the long lapse of time no tidings either of their continued existence or of their place of abode had ever reached him. Nor is it strange that, when he eventually roused himself to make those inquiries, he found none of the few who remained to him of the old circle of his acquaintance who were competent to answer his questions satisfactorily. The Tozers? They knew nothing of the Tozers. Ah! Miss Marmaduke that was? Yes; they just remembered the young lady, and the circumstances of her marriage; but she and her husband left London years and years ago, and where they went, or whether they were dead or alive, no one could tell.

"My dear Jack," said Mrs. Meredith, an elderly and very infirm old lady, on whom Mr. Falconer called one day, I being his companion; and, as she spoke, she pressed his broad, big hand with hers, which was thin, wrinkled, and tremulous—"My dear Jack, why are you so anxious to know anything about that very treacherous man and his poor, silly wife? They are far beneath your notice; and I hoped that, by this time, you had almost entirely forgotten them."

Mr. Falconer shook his head gravely. "My memory is too sadly retentive," he said; "and, as old age creeps on, I find that former scenes and circumstances stand out in bolder relief than they did twenty years ago."

"Old age, indeed!" returned the lady, with a smile. "You must not begin to talk of old age yet. Wait till you have passed beyond the three score and ten years of the palmist, as I have; and then, indeed, you may say that old age is creeping on. But you are right about former scenes being revived as we grow older: I have long experienced that strange phenomenon. I don't believe there is such a thing as real and entire oblivion: memory does not get old. But you have not answered my question: to what end do you go about distressing yourself in seeking to know that which would be far better buried in ignorance?"

"Simply, my dear lady, that I may bury my past resentment in an act of justice. And I can tell you, moreover, that my remembrances of the past do not distress me, as you imagine: they only soften me. I think of poor Frank as my boyish companion and friend, of the many acts of mutual kindness that passed between us."

"All sheer selfishness and guile on his part," interposed the old lady, sharply.

"I did not think so then, and, though I have since fancied it might have been so, I do not wish to think it now," said Mr. Falconer. "But, if they were, I have, as I have just said, an act of justice to perform. I have no other relatives in the world than Frank and his wife, and his children, if they have children."

"I see. The great Silver estate is not to go begging, then?"

"No, nor to furnish picking for lawyers, either, if I can help it. I intend, before I leave London, to make my last will and testament."

"And you want an heir. But do you tell me, Mr. Falconer, that you have lived all these years without having made a will?"

"No; I have not been quite so unwise. I made a will thirty years ago, when I was smarting with disappointment, and burning furiously with resentment. You may guess what sort of a will that was. I made another twenty years ago, which, ten years afterwards, I revised. But I am not satisfied."

"Well, I have no right to pry into your secrets, my dear Jack, nor to criticise your actions," said the kind old lady. "I would help you if I could; but I really have not the slightest recollection of having ever heard what became of those people. By the way, have you thought of looking into the law lists, or making inquiries at the Stamp Office? Attorneys have to take out a license to practise, I believe."

"Yes; in common with hawkers and other worthies. And you may be sure that I have left no stone of this sort unturned; but without success. Poor Frank seems to have slipped out of existence."

"Perhaps he may have done this in reality. Why not advertise, and offer a reward to any one who can give information on the subject?"

"Ah, this is the advice my friend Bix gives me; and it will have to be my last resource, though I would have avoided the publicity if I could," returned Mr. Falconer. "However, there seems to be no alternative, and it shall be done."

I very well remember this conversation, though at that time I did not perfectly understand it. Presently it turned to other subjects of less interest to my story, and then we took our departure.

CHAPTER XII.—MY FIRST JOURNEY.

ABOUT three weeks after the visit to which I have just referred, a letter for Mr. Falconer arrived by post, and was put into his hands as we—that is to say, he, my grandfather, and I—sat at breakfast. Breaking the seal, Mr. Falconer commenced reading the letter; then he hastily rose and left the room, apparently disturbed and agitated. He soon returned, however, and apologized to my grandfather for his rudeness, as he called it.

"No unexpectedly bad news, I hope, sir?" said that gentleman.

"Startling, but not very strange, perhaps. My advertisements have taken effect, at any rate," said Mr. Falconer, gravely.

My grandfather raised his eyebrows and nodded.

"Poor Frank is dead," continued my grandfather's patron, with a sigh—"has been dead ten years; and Julia—but read the letter for yourself, Bix, and tell me what you think of it," he added, passing the epistle over to his faithful steward, who carefully adjusted his spectacles, and obeyed the instructions.

"A rather singular letter," he remarked, presently.

"Ah, you would say so, I knew that. But what is to be done next?"

"That is for you to decide, Mr. Falconer," said my grandfather.

"I don't know about that. Tell me what you think," returned the patron.

"The lady seems very desirous of renewing old friendships, sir," observed Mr. Anthony Bix. "Hurly, my boy," he added, turning to me, "there's a note on my office-table I want taken to Fleet Street; run with it, and wait for an answer."

Understanding this to mean that I was one too many in the conference, I withdrew and departed on the errand, which might as well have been delayed a week for any

haste that it required; and on my return the subject of the letter seemed dropped for that day and the next. On the day after that, however, I was made aware that Mr. Falconer intended to take a journey into Kent in the following week, and that I was to accompany him.

Since my first introduction to Silver Square I had never been beyond the outskirts of London, and I was delighted enough with the thought of the trip, especially when I learned that we were to travel not by the ordinary conveyance of a stage-coach (the time of which I am writing being long before railroads were thought of), but in a grand carriage hired for the occasion, drawn by post-horses.

I pass over the intermediate days to the eventful morning when, gorgeously equipped in my Sunday suit, and with a small bag containing a change of clothes (for our journey was planned for several days), I sprang into the carriage by the side of Mr. Falconer, the silent Alphonse having packed himself into the rumble behind us. Our adieux were soon spoken, and then merrily whirled round the wheels at the crack of the postillion's whip, and we left Silver Square behind us, greatly excited, no doubt, by the unwonted stir we had made. Soon, too, the city was in our rear, and in an hour we were gaily bowling over the smooth turnpike road, with green hedges and meadows on either side.

I have no intention of describing the day's journey along one of the pleasantest roads leading out of London: it is enough to say that, at three o'clock in the afternoon, we drove into the old-fashioned city of Canterbury, and drew up at one of the principal inns, where we alighted, and where also Mr. Falconer ordered what seemed to me a sumptuous banquet. Not that he was an epicure, for his habits were particularly simple; nor that our eight or nine hours' journey had quickened his appetite; for, when the dinner made its appearance, he contented himself almost solely with vegetables and bread, washed down with a glass or two of wine. But it was characteristic of him to think a good deal for the comfort of others; and if he chose to starve himself, that was no reason why I and Alphonse should be starved too—so he said, as he pressed upon me with the kindest solicitude the choicest morsels from the various dishes set before us. This is a simple thing to relate, or even to remember, perhaps, after so many years; but I will not blot out what I have written, because it is indicative of the kindness which, in those early days, I constantly received from Mr. Falconer.

And I may as well say also, as another of my remembrances of that particular day, that our journey from London to Canterbury was a very silent one. In general, when at home by ourselves, Mr. Falconer was ready enough to enter into conversation with me, drawing me out, to use a common expression, to speak of my own scant attainments under the fostering care of Betsy Miller, and of my wishes and hopes for the future; then giving me interesting accounts of the foreign countries in which he had lived, and, what pleased me almost better, lively anecdotes of his boyish days at school. But on the day of our long journey (it seemed long to me then) Mr. Falconer had spoken very few words from the time of his first stepping into the carriage, save to give necessary instructions to the post-boys, who were, of course, changed at every stage. It seemed to me that he was lost in some deep and solemn reverie, in which he almost forgot, not only my presence as I sat by his side, but also that he was travelling anywhere. Once or twice, when I ventured, with boyish freedom, to call his attention to any object which attracted mine, as we whirled rapidly along, he started up in a kind of

bewilderment, and retorted to my exclamations, "Oh yes, Hurly; very curious, very curious indeed," and then immediately subsided into his silent state. I was not sorry, therefore, when our day's journey was broken by our arrival at Canterbury and the necessity for dining. For it was but a break in the journey, in so far as one more stage had to be passed over before it was ended.

Accordingly, when we had dined, and, like true Canterbury pilgrims, had visited the shrine of St. Thomas à Becket, and glanced at the other noted sights of the archiepiscopal city, we resumed our seats in the carriage, and, after another hour's drive, came to our resting-place at an old-fashioned inn, in the equally old-fashioned, but pretty little town of Wingham, where the kind-hearted landlady of the "Lion," compassionating my evident fatigue, to say nothing of a terrible headache, induced, I am afraid, by my over-generous dieting at Canterbury, insisted on putting "the poor little fellow" to bed, which she did, and, with her own hands, tucked me in comfortably between the sheets, bestowing on me a motherly kiss as she bade me good night, and charged me to sleep soundly till morning—which I did.

CHAPTER XIII.—A MORNING CALL IN THE COUNTRY.

"Now, Hurly, for a good long walk this morning. Can you manage to stretch your legs, do you think?"

We were at breakfast in a fine large room in the "Lion" (which had once, as we were told, lodged a king, or some royal personage), when Mr. Falconer thus addressed me. He had been up and dressed, and had explored the town from one extremity to the other, before my eyes were open, or my head removed from its pillow; so he told me. But he had good-naturedly waited till I was ready to join him at the breakfast-table.

I was prepared to accompany him, of course; and before long we were on the road, being well stared at as we passed through the town, first because we were strangers, and next as being under suspicion as foreigners, a conclusion not unnaturally arrived at, in consequence of Mr. Falconer's luxuriant beard and rather fantastic costume.

It matters nothing to my story to what part of the surrounding country our steps were directed. For the gratification of the curious, however, I may briefly tell that we passed through a large and very pretty park soon after leaving the town, and afterwards through another before arriving at our destination. I may add, also, that Mr. Falconer had by this time recovered from his previous day's fit of taciturnity.

"Do you know, Hurly—no, you don't know, but can you guess what has brought us into Kent?" he asked, gaily, as we trudged along.

Now the truth is, I had guessed. I had retained in my mind the conversation Mr. Falconer had held with Mrs. Meredith, two or three weeks before, and the scrap of a dialogue which had passed between him and my grandfather still later; and I had had no great difficulty in arriving at the conclusion that his object was to visit the lady whom he had called Julia, and for whom he had advertised. So said I—

"You are going to see Julia, I think, sir?"

"Ha! and who told you about Julia?" he asked, with some evident amusement.

"Nobody, sir; only you mentioned that name to my grandfather when I was by; and I thought you seemed a little glad when you had that letter from her."

"Only a little glad, Hurly?"

"Glad and sorry, too, sir," said I.

"You young rogue," rejoined the gentleman, kindly

laughing, and pretending to threaten me with his walking cane: "I didn't know you were so sharp."

"You asked me if I could guess, sir," I retorted, apologetically.

"And you have guessed rightly. I am going to see an old friend (we may call her Julia here, when there is no one else present). I have not seen the lady, nor even heard of her for more than thirty years. Do you think she will be glad to see me—as glad to see me as you fancied I was to hear from her?"

"Perhaps she will be sorry, sir—as sorry as you seemed to be," I retorted, saucily.

"Perhaps," said Mr. Falconer; but he did not seem to think so.

"Maybe she will not be glad to see me," I said, presently.

"Ha! what makes you think so, Hurly?" he asked.

"You two may have so many things to talk about that she would not like me to hear," I replied.

"We must get out of ear-shot, then," he retorted, laughing one of his pleasant laughs. "At any rate, I dare say we shall manage to dispose of you somehow."

"Is she a nice lady?" I asked, presently—that is to say, when we had walked a quarter of a mile side by side, silently.

"She! Who are you talking of, Hurly?" demanded Mr. Falconer, waking out of a brown study into which he had fallen.

"Julia, sir."

"How should I know, sir?" he rejoined. "Didn't I tell you I had not seen her for thirty years? People alter very much in thirty years, Hurly."

"Yes, sir; I dare say they do," I assented.

"Your grandfather was a handsome enough young fellow when I first knew him thirty years ago. And I—"

"You are very handsome now, sir," I interposed. Do me the justice, reader, of giving me credit for meaning what I said. As to the freedom of my remarks I have only to say that I did not mean to be impertinent. The fact is that, in my two or three months' companionship with Mr. Falconer, he had so far caused me to forget the fifty years' difference in age there was between us as to make familiarity in conversation a matter of course; indeed, I verily believe that he sometimes half fancied himself a boy like myself when we were together, or perhaps there was a little guile on his part to "draw me out," as I have before observed; at any rate, he took my interruption in good part.

"You are a gross young flatterer, Hurly," said he; "but it is not worth laying my stick about your back, either; and so I will tell you that thirty years ago the young person whom you heard me call Julia was a very nice lady—at least, I thought so. She had a very charming temper, as I believed, and I know she had a soft and gentle voice, bright brown hair, sparkling eyes of no particular colour that I can remember, teeth white as ivory or whiter, pretty pouting ruby lips—which you know nothing about at present, Hurly—a delightful little nose, not at all Roman, but rather the reverse, and dimpled cheeks and chin. You see how perfectly I recollect, eh?"

Poor Mr. Falconer! I did not suspect then how he was trifling with his own feelings to give me a little amusement; or was he grimly and resolutely holding up himself to himself in a ridiculous light, to keep himself from playing the fool in the approaching interview? I cannot tell.

"You have a very good memory, sir," said I, innocently.

"Oh, very. But what do you think of the portrait I have drawn, Hurly? Will it do for that of 'a very nice lady'?"

"Pretty well, sir," I returned, rather impudently, I am afraid; adding, "only——" but Mr. Falconer cut me short with—

"Without joking, Hurly, I was very fond of that young lady when she was young; and now she is so much older I feel sorry for her. She has had a good many troubles to bear, I find. She has lost her husband—Frank Tozer, my cousin, of whom you have heard me speak—she has buried several children, and I am afraid she is not very well off. So we must do what we can to comfort her; eh, Hurly?"

"Yes, sir."

"She has a son—only one, I am told—and he is about your age; a little older, perhaps; and I have brought you with me partly that you may make his acquaintance. I cannot tell what sort of a boy he is; but, as it is possible that you may know something of each other as you grow older, I wish to see how you get on together. Do you understand me, Hurly?"

"I think I do, sir," said I; and I thought I did. I could not help knowing, for instance, that Mr. Falconer was a rich man, without any other relatives than these newly sought and found distant cousins. I was only a boy, to be sure, and not a very precocious one either, I hope; but I had heard something about heirship, and knew, at any rate, that when people die they do not take money, or houses, or lands with them into the grave, consequently that they leave their wealth to others. I had heard what Mrs. Meredith had said about the Silver estate not going a-begging, and Mr. Falconer's wanting an heir; and it required no great stretch of sagacity, even in me, to arrive at the conclusion that this boy whom he had never seen, and of whose existence he had till lately been ignorant, but who was the son of Mr. Falconer's cousin and of the lady of whom he had once been fond, was on the fair road for this heirship, if all things turned out well. I even had the boldness to wonder whether the gentleman had any intention of offering himself as a second husband to the widowed lady whose youthful charms he so distinctly remembered, and whom he was so anxious to comfort. All this passed through my mind as one branch of the subject; another branch was that Mr. Falconer had kindly feelings towards myself, and had promised to do something at the proper time for my advancement in life; though what that something, or when that proper time, might be was left undecided. I could understand, therefore (knowing nothing then of Mr. Falconer's early history), or thought I could understand, that he was desirous of initiating a friendship which was to last through life between the two boys, who were to profit, in different ways and in different proportions, by his benevolence while he lived, and by his death when he died. This was plain enough to me then.

I confess, however, that I do not now, since I have known his previous history, comprehend Mr. Falconer's motive in bringing myself and that unknown boy together. One might imagine that he would so have remembered the course and termination of his own boy-friendship and confidence as to have kept us, the heir-presumptive and the poor dependant, far apart from each other. It is useless to puzzle one's self, however, to discover motives for human conduct, or reasons for human inconsistencies. I return to my story.

An hour's brisk walking brought Mr. Falconer and myself to a rather large and scattered village; and here we halted, at a blacksmith's shed, as I remember, while

my companion asked one or two questions bearing on the object of his journey. Ascertaining, at length, and after being curiously stared at as before, that the person about whom he inquired lived half a mile farther on, and having obtained a description of her residence, we proceeded on our way, until, after passing through a trim flower-garden, we stood at the entrance of a moderate-sized brick house, with steps up to the door so very white that it seemed almost profanation to soil them with our dusty feet, and with every window-blind so closely drawn as to indicate a standing quarrel between the bright cheerful summer sun and the house's mistress. Undeterred, however, by these forbidding signs, Mr. Falconer gently knocked at the door, and we were presently admitted by a small servant whose eyes appeared to be red and moist with recent crying, and who, after vainly endeavouring to extract from my leader his name and business, save that he desired to see her mistress, rather unwillingly as I thought, introduced us into one of the darkened rooms, and departed on her errand. I judged by this, therefore, that Mr. Falconer had not pre-announced his intended visit.

Some time elapsed before we were disturbed; but as we sat in silence I could not shut my ears against the penetrating sound of certain distant voices, one of which I believed to be that of the diminutive handmaiden, who seemed to be plaintively defending herself from the angry chidings of the other voice, which was remarkably sharp and high-pitched; nor could I avoid fancying that I presently heard the discussion, or conversation, suddenly closed by a smart concussion, very suspiciously like that caused by a box on the ear, which was succeeded by a subdued and smothered scream. Then ensued a few hysterical sobs, followed by a deep silence. Upon this, I ventured to glance at my companion, and was glad to observe that he apparently had not heard the ominous sounds which had stricken me with a kind of boyish terror, but that he had gently drawn up one of the window-blinds, and was gazing out upon the road, evidently buried in his own thoughts. I could not help wondering, however, how a lady of so sweet a temper and so soft and gentle a voice as, according to Mr. Falconer's account, belonged to the Julia of his younger days, could endure the presence of such a termagant as the unseen female undoubtedly was.

While pondering this knotty problem, a gliding of female steps in the passage preceded the opening of the parlour-door, to admit a lady of whom I will endeavour to give a brief description from memory.

She was short in stature, and exceedingly thin. Her cheeks were hollow, partly owing, I suppose, to the loss of teeth; her complexion was sallow; her hair, such as could be seen of it from under the pent-house of—well, let me call it a morning cap, a large morning cap, composed of checked muslin—was of coarse texture and dark hue, streaked rather plentifully with gray. Her eyes, though partly concealed by green spectacles, yet seemed to me to sparkle angrily; while the more prominent feature in the lady's countenance was sharply pointed, rather turned up, as though in disgust at the follies of the world, for which, also, it deeply blushed—at the tip.

The lady whose portrait I have thus imperfectly drawn was attired, from neck to ankle, in a close-fitting morning robe of a yellowish material, which was dear to prudent and economical house-dames in those days, and which I have since learned is, or was, India nankeen; it having the excellent quality (so I have been told) of never wearing out. The lady's feet were encased in list slippers. Of her head-dress I have already

spoken. Add to this costume that her hands were slipped into an old pair of dark kid gloves—for gentility's sake, I suppose—and the drawing is sufficiently complete.

It is not to be supposed that these particular observations were taken by me at the first entrance of the lady, but rather that the several details impressed themselves upon me in the interview which ensued. Indeed, she gave but little time for silent remarks of any kind, as she moved forward with a quick and angry step towards the unblinded window, from which Mr. Falconer had withdrawn, pulled down the blind with a fierce jerk, and said, in a voice which I recognised as that which I had previously heard—it being sharp and high—

"A very great liberty to meddle with my blinds, sir."

"This must be the lady Julia's housekeeper," thought I to myself, as Mr. Falconer made a low and silent bow; "and a very queer-tempered housekeeper she is, too."

FAR-OFF VISION.

UNDER the title of "A Long-sighted Subject," an account was given in "The Leisure Hour" for May 1863 (p. 319) of a Frenchman in the Mauritius named Fillifay, who professed to see objects at incredibly remote distances. There is no doubt as to the facts recorded. He used to announce the approach of ships days before they hove in sight to ordinary eyes, and his statements were usually unquestioned. He is said to have died in the beginning of the French Revolution, without disclosing the principles of far-off vision. Many attempts have since been made to explain or account for the phenomenon. A letter has recently appeared from Mr. Thomas Trood, a resident in the Samoa Islands, attempting a new explanation:—

In August 1859 I began my analysis, thus: Bottineau (he calls him) did not make out objects by *mirage*; he must, then, have seen them by a *figure*, the result of the working of some law of nature known to him alone. I then considered that, clouds and sky being the only things visible above the horizon, the secret lay in one of these. The question was, which? Now, to have supposed that Bottineau indicated objects when the heaven was altogether cloudless, was to take it for granted that his eyes were powerful enough to perceive some very subtle reflection above the horizon, or refraction on it, too fine to be made out by other men; a conclusion directly opposed to his own statement, that strength of eyesight had nothing to do with his observations.

Having scanned the sky for some months previously from sunrise to sunset, I felt persuaded that no such reflection or refraction in a cloudless heaven, perceptible by eyes of ordinary power, could possibly have escaped my notice. As, too, during the period alluded to, we had passed over thousands of miles of ocean, sighted various vessels, and been constantly within two or three days' sail of some island or another, such phenomena (if there were any) must have constantly presented themselves. Thus, then, finding no footing in a cloudless sky, I dropped necessarily on to the clouds. The more I considered the subject, the more I became convinced that in clouds, and *in them alone*, an explanation of Bottineau's power could be found. But here again the question was, which? The word *cloud* has a wide meaning.

In November 1859, while on the voyage before mentioned, we sighted Aitutaki (in lat. S. 18°54, long. W.

159°41'), and stood to the northward, bound for Penryhn's Island (lat. S. 9, long. W. 158). The next day, at sunset, looking in the direction of the island we had passed, I perceived a small low bank of dark clouds on the horizon, resembling Aitutaki in shape. It continued for some time. The next evening, at sunset, I watched again, and the same appearance presented itself in the same direction. We did not make Penryhn's Island for a fortnight afterwards, and in that interval I watched hourly the clouds; but they presented such a variety of forms, and changed their positions so arbitrarily, that at the close of the period I thought seriously of abandoning the subject altogether. But in January 1860 it was proved to my satisfaction that certain clouds exhibit a remarkable and positive sympathy with the land adjacent to them—this fact being most apparent in black clouds, at sunrise when the land lay to the eastward, and at sunset when the land bore west; and that at all other times of the day the sympathetic clouds presented a *yellow tinge*.

In August 1860 I commenced a series of careful and systematic observations at this port (Apia, Samoa, or Navigator Islands, lat. S. 13°48', long. W. 171°46'), and in August of the following year I laid down the following general rules, deduced from the results of my observations:—

Rule No. 1.—Clouds, black, small, like distant land, *on (not above)* the horizon, presenting the exact appearance of distant land, indicate land at great distance, say 350 miles, more or less, to one-eighth point of the compass. I name such indications *Vraisemblances*.

Rule No. 2.—A very bright horizontal streak or patch about five degrees above the horizon, and about five degrees in length, reddish yellow, and very bright, will sometimes exhibit itself in the direction of very distant land, 300 to 400 miles off. I name this indication *La Verité*.

Rule No. 3.—Small yellow.

Rule No. 4.—Small white clouds, very similar, in shape and size, to Rule No. 1, will indicate land at great distances. These will always appear *on, never above*, the horizon. I name them respectively, *Jaunesemblance* and *Blancssemblance*.

All other appearances in the heavens traverse *with* the wind, or *against* it when in the upper regions of the air—that is, *with the upper current of air*. Although these phenomena, these various aspects of the clouds, fade and disappear, they never change their *position* while visible to the eye.

Rule No. 5.—Heavy black clouds, large and small, *on the horizon*. The same phenomena will indicate invariably at and after sunrise (though not invariably at other times of the day), in *clear* weather, land at *limited distance* to the westward of the observer. These masses sometimes bank, if the land be near—eighty miles say—and generally cover from half a point to a point and a half of the compass, according to the distance of the land, a fraction of which is the land's direction.

Rule No. 6.—In clear weather masses of moderate-sized yellow clouds resting *on the horizon*, and covering not more than three-quarters of a point of the compass, will indicate land. These exhibit themselves at all times of the day, excepting at sunrise and sunset; and the deeper the yellow, and the more circumscribed their limits, the truer the indication. Nos. 3 and 4 often rise amongst Nos. 5 and 6, but No. 3 will never appear at or before sunrise, or at or after sunset.

Rule No. 7.—A light mass of yellow cloud, apparently very distant, and *stretching upwards* from the horizon, which it *touches* at angles of from 45° to 70°, indicates

land under that point of the horizon with which it connects.

Nos. 1, 2, 3, and 4 are not affected by the wind. Nos. 1, 3, and 4 rarely remain visible longer than from ten to fifteen minutes, and are *never detached from the horizon*, having just the same appearance (as regards contact with the horizon) from the topgallant yard as from the deck. This remark is important, for there are apparent "*Vraisemblances*" of no value whatever, *because* they are detached from the horizon. "*La Verité*" never traverses and quickly fades. There is also an apparent "*La Verité*"—a light streak, not bright and traversing, therefore of no value. Nos. 5, 6, and 7 traverse; but the latter (Nos. 6 and 7) lose their colour in doing so. No appearance or cloud that is not *on* or does not *touch* the horizon (excepting always "*La Verité*") is of any value in the present state of the discovery. By "*clear weather*," I mean a bright day, with no clouds in the heavens, but bright yellow masses (No. 6) on the horizon, or casual clouds near the zenith, whose bases have an altitude of at least 45°. By "*very clear weather*" I mean that state of the atmosphere in which nothing is visible in the heavens but Nos. 1, 2, 3, and 4.

I now changed my plan of observations. Since I settled on this island, I had examined only the clouds seaward from the land, southward from the island. But now I began to examine the clouds *about and over the island*. Towards the end of 1861, I had partially arrived at the conclusion that these masses of vapour at certain times bore a great resemblance to the masses of land, or their prominent parts, which were adjacent to them. And in December 1861 the point was settled in my mind to this extent—that should I, in seaward observations, fall in with anomalous clouds like those before mentioned, and that should such anomalous clouds bear resemblance to vessels, even in a very slight degree, then such clouds should be indications of vessels. The rules before mentioned as applying to land should, therefore, apply equally to vessels; and, allowing that such clouds are the indications of vessels under them, then all clouds should bear the images of or reflect those objects whose presence they indicated; and, consequently, that all clouds should be *mirrors*.

In January 1862 I resumed my seaward observations from the port of Apia, where I am now writing. I perceived an anomaly in the clouds—a resemblance, though in but a slight degree, to a schooner away to the eastward. Two days after, she arrived, and proved to be the "*Matthew Vasa*," from Tahiti, and was, according to her log-book, 180 miles distant on the day I first saw her indications in the clouds. Other vessels were also seen by me at about the same distance during the month (January 1862), all of which vessels duly arrived in this port. The success was complete, and nothing remained but to perfect the discovery. I then laid down the following principle as that which is at once the basis and the explanation of Far Vision; viz., that all clouds in the heavens, whatever be their form, colour, or shape, however situated, or whatever be the state of the atmosphere, owe their peculiar appearance, their form and outline, to optical laws, the most potent of which optical laws is, that every mass of clouds possesses all the properties requisite to receive and evince a *light image* of an object or objects adjacent to it, and that its outlines, or apparent outlines, in all instances, bear the most striking testimony to the truth of this law.

We commend the further investigation of the subject to the meteorologists of the British Association.

PRINCIPAL JAMES DAVID FORBES.

AMONG the eminent living cultivators of physical science, few names are more widely known or more highly distinguished than that of James David Forbes, recently Professor of Natural Philosophy in the University of Edinburgh, and now Principal of the United Colleges in the University of St. Andrew's. The fourth son of the late Sir William Forbes, of Pitsligo, Baronet, he was born at Edinburgh, on the 20th of April, 1809, and is descended from an ancient noble Scottish family, through the Hon. Duncan Forbes, of Corsindae, the second son of the second Lord Forbes. The Nova Scotia baronetcy held by his family was created by patent, dated 2nd April, 1626. Of the line of baronets the most noteworthy was Sir William Forbes, the sixth in succession, the well-known Edinburgh banker, and the grandfather of the subject of this notice. Successful in business, he was able, in 1781, to purchase the family estate of Pitsligo, in Aberdeenshire, forfeited by Lord Forbes, of Pitsligo, on account of his adhesion to the cause of the Pretender, and active participation in the Rebellion of 1745. On acquiring this property, Sir William restored the dilapidated mansion, introduced extensive improvements, built cottages, chapels, and schools, and converted a large tract of uncultivated moor into fertile fields. Not less active in the support of benevolent institutions than in his own affairs, he was likewise the ardent promoter of all public measures for the benefit of Edinburgh and for the encouragement of the agriculture and trade of the country. Addicted to letters, he was one of the earliest members of the Literary Club in London, and enjoyed the friendship of Dr. Johnson, Reynolds, Burke, and other literary celebrities of that period.

In 1805 he published the life of his friend Dr. Beattie, a work which preserves much of the literary history of the country which might otherwise have been lost. The author of "Marmion," in the introduction to canto 4th of that poem, pays a touching tribute to the memory of Sir William Forbes, and elsewhere says of him, "he was unequalled, perhaps, in the degree of individual affection entertained for him by his friends, as well as in the general respect and esteem of Scotland at large."

A work written by Sir William, in 1803, three years before his death, and addressed to his eldest son, the late Sir William Forbes, was recently published, under the title of "Memoirs of a Banking House." In this interesting and instructive book the writer narrates the history of the firm of Messrs. Coutts, of Edinburgh, with which he was connected, as a clerk, in 1753, at the age of fourteen, and of which, under the style of Forbes, Hunter, and Co., he afterwards became the chief partner. Subsequently the house was known by the designation of Sir William Forbes and Co. The late baronet, the father of Principal Forbes, having been trained up to business in the bank, and having finished his apprenticeship in 1794, was in that year admitted a partner; and on the death of his father, in 1806, he became the head of the firm, which continued to flourish until 1838, when it was merged in the joint-stock Union Bank of Scotland.

The late Sir William Forbes, the seventh baronet, married the sole child and heiress of Sir John Stuart, of Fettercairn, a lady to whom frequent allusion is made by Sir Walter Scott, in his letters and Diary. Sir William acted a very generous part towards Scott when overwhelmed by the commercial disasters which overtook him in 1826. He died in 1828, leaving his title to his second son, Sir John Stuart Forbes, Baronet (recently

deceased), the eldest son, William, having died in his lifetime. The third brother was Charles Hay Forbes, of Blackford House, near Edinburgh, whose eldest son is now Sir William Stuart Forbes, Bart., of Pitsligo.

James David Forbes, the fourth and youngest son of the late Sir William, was educated at the University of Edinburgh. He distinguished himself as a student, and gained the highest honours. In the moral philosophy class, taught by the celebrated Professor Wilson, the first prize was adjudged to him; and in the natural philosophy class, presided over by Sir John Leslie, he carried off, in two successive years, the gold medals. So many attractions had natural philosophy to Mr. Forbes, that, although he had studied law, and was admitted a member of the Scottish bar in 1830, he finally resolved to follow the bent of his inclination, and to devote himself to scientific pursuits. While yet a minor, he became a frequent contributor to the "Edinburgh Journal of Science," conducted by his friend Dr. (now Sir David) Brewster. His first paper appeared in that journal in 1826, when he was only seventeen, and is entitled "An Attempt to Account for the Fact that the Stars appear Greater in Number when Viewed cursorily than when Examined with Attention." In the following year, in the same periodical, we find papers written by him on Mount Vesuvius and on the climate of Naples. In 1828 he published no less than eight distinct contributions to science—five in 1829, two in 1830, and four in 1831. In that year he was admitted a member of the Royal Society of Edinburgh, a body to which he has largely contributed papers on scientific subjects, and for many years acted as secretary. In 1832 his published papers amounted in number to ten. Very early Mr. Forbes impressed the *savans* of the northern capital with a high opinion of his activity and zeal as a scientific inquirer. All this, however, was preparatory to still higher distinctions. On the 5th March, 1832, he was recommended for election to the membership of the Royal Society of London, "as highly deserving of that honour, and as likely to prove a valuable and useful member." The recommendation bears the signatures of David Brewster, Roderick I. Murchison, and Adam Sedgwick, and of eleven other eminent men. On the 7th of June succeeding, Mr. Forbes was elected, and thus became a Fellow of the Royal Society at the age of twenty-three.

At the second meeting of the British Association, held at Oxford in the same month of June, 1832, Mr. Forbes read a lengthened report, prepared by him, on the progress of meteorology, which impressed Dr. Buckland with a sense of "its value and masterly excellence."

The chair of Natural Philosophy was in 1832 occupied by Sir John Leslie, who had succeeded the equally celebrated Professor Playfair. It was evident that Sir John's advanced years and failing health would ere a very lengthened period render the chair vacant. Mr. Forbes aspired to be his successor. Towards the close of the year, when at Geneva on an exploring tour, he heard the unexpected news of the death of his respected teacher and friend, and also that his brother Sir John Stuart Forbes, acting in accordance with what he knew to be his wish, had proposed him as a candidate for the vacant chair. Immediately he hurried home to promote his candidature in person. His formal letter of application to the Town Council of Edinburgh, in whom is vested the right of election, bears date 21st December, 1832: in this letter he states one of his objects to be "to raise, if possible, the character of this most important class, and to foster the taste for some of the higher

acquirements in science, which we have long been reproached with not sufficiently cultivating in our universities." In this connection it is interesting to recall that, had Sir John Leslie been able to carry out his intention of going abroad, Mr. Forbes was to have conducted his class during his absence; and that Sir John was the first professor who witnessed the electric spark which Mr. Forbes obtained from Dr. Hope's magnet—an experiment which greatly delighted the Professor, and of which he gave an account to his class.

These facts indicated the high opinion entertained by Sir John Leslie of his favourite pupil's scientific acquirements, and helped to strengthen the claims of Mr. Forbes as a candidate for the Natural Philosophy Professorship. But testimonies of equal value were furnished by most of the eminent scientific men of the day. Sir John Herschel speaks of Mr. Forbes "as marked by nature for scientific distinction if he should continue to aim at its attainment," and observes also on "the valuable union which he exemplified of careful diligence in the observation of facts, and just philosophical views in combining and reasoning on them, together with a remarkably extensive knowledge of the investigations of predecessors and contemporaries in a great variety of different branches of inquiry." The testimonial of the late Dr. Whewell, of Trinity College, Cambridge, is to the following effect: "On some of the subjects belonging to the Professorship of Natural Philosophy he [Mr. Forbes] is better acquainted than any one I know with the labours of preceding philosophers, and has prosecuted with very extraordinary labour and care important trains of research. I refer in particular to the doctrines of heat, moisture, magnetism, and meteorological inquiries in general. His laborious and exact measurement of the daily and hourly heights of the barometer, with the detection of the diurnal variation, and his extraction of the electric spark from the natural magnet, are in the recollection of everybody acquainted with these subjects. And in his report on the present state of meteorological knowledge read before the British Association in June last, there was given the most ample evidence of his exact and extensive acquaintance with the literature of the subject. As he is, moreover, an accomplished mathematician, and well acquainted with the analytical labours of the French and English writers on applied mathematics, he appears to me to combine all the attainments which belong to the office. I may mention his notices of the Bay of Naples, where he has connected physics with geology. His account of the celebrated puzzle of the temple of Jupiter Serapis is well known, having been in a great measure adopted by Mr. (now Sir Charles) Lyell." In connection with his candidature other tributes to the youthful zeal and ardour of Mr. Forbes in the prosecution of scientific inquiries might be cited; but the above will suffice. His ambition was rewarded by his election in February 1833 to the chair occupied by such illustrious predecessors as Playfair and Leslie. In what follows of this article it will abundantly appear that the expectations formed of him have not been disappointed; and that by his writings and discoveries he has not unworthily maintained the renown which attaches to the chair of Natural Philosophy in the University of Edinburgh. A professorship held at so early an age as twenty-three was no novelty in the annals of the Scottish Universities. The first Monro was Professor of Anatomy at twenty-one, and the second Monro, his son, at twenty-three. Maclaurin occupied the chair of Mathematics at nineteen; and Dugald Stewart that of Moral Philosophy at twenty-two!

After his elevation to the chair, Professor Forbes continued to turn his attention to the subject of heat. From a series of experiments he concluded that the metals range in the same order as conductors of heat and electricity. The results at which he arrived were embodied in a contribution to the Royal Society of Edinburgh, which appears in the first volume of its Proceedings. In 1833, when at Paris, Professor Forbes witnessed Melloni's experiments on the transmission of heat; and at the meeting of the British Association at Cambridge immediately succeeding, he made known their importance to scientific men in this country. In consequence of this communication the Rumford medal was awarded to Melloni by the Royal Society of London. In the year succeeding Professor Forbes applied Melloni's instrument, the thermo-multiplier, to the polarization of heat. Heat he polarized by transmission through thin mica plates; next he attempted the polarization by reflection, and succeeded by the use of reflecting surfaces of mica; he succeeded also in the more delicate problem of the depolarization of heat by plates of mica. These researches tended, as appears from Professor Forbes's paper on the subject in the "Edinburgh Transactions," to confirm the identity of the laws which regulate light and heat.

It was for his experiments on the polarization of heat that the Rumford medal was awarded to him in 1838 by the Royal Society of London.

The fourth meeting of the British Association was held at Edinburgh in 1834, and upon Professor Forbes was laid the task, as it was on Dr. Whewell in the preceding year at Cambridge, of delivering an address to the Association. This address was afterwards published in a separate form. From a paper in the "Edinburgh Transactions" for 1840, it appears that meteorological observations about this time engaged his attention, and by which he proved the diminution of temperature with the height of the atmosphere.

In 1843 the royal medal of the London Royal Society was presented to him for his paper entitled "On the Transparency of the Atmosphere, and on the Law of Extinction of Solar Rays in passing through it." We cannot enumerate all the contributions made by Professor Forbes, from time to time, to various scientific societies; but we may instance the following:—"On the Determination of Heights by the Boiling Point of Water" (1844 and 1857); "On the Temperature of the Earth's Crust at varying Depths near Edinburgh" (1849); "On the Volcanic Geology of the Vivarais (Ardèche)," (1848); "On the Geology of the Eldon Hills, in Roxburghshire" (1851); and "Inquiries about Terrestrial Temperature" (1859). The Bakerian lecture for 1846 was read by Professor Forbes, before the Royal Society of London, in the form of three papers, entitled "Illustrations of the Viscous Theory of Glacier Motion."

In 1839 Professor Forbes made an excursion on foot to the Alps of Dauphiné; and again, towards the end of July 1841, having previously explored part of the volcanic country of Central France, he visited that mountainous region, which is accessible only during a few weeks in the middle of summer. Early in August he proceeded to the Grimsel Hospice, in the canton of Berne, under engagement to meet M. Agassiz, then of Neuchâtel, and now of the United States of America. Together these distinguished men proceeded to inspect the lower glacier of the Aar, and encamped for some weeks under a huge stone on the moraine of that noble glacier. Here Professor Forbes made a more intimate acquaintance than heretofore with the varying features of the astonishing ice-world. "I shall never forget," he

says, "the charm of those savage scenes; the varying effects of sunshine, cloud, and storm upon the sky, the mountains, and the glacier, the rosy tints of sunset, the cold hues of moonlight, on a scene which included no trace of animation, and of which our party were the sole

to his class on the subject of glaciers during the ensuing months of December and January, and in April published in the "Edinburgh Review" an article on the same subject, detailing his experience in 1841, and insisting on "the importance of considering the



Believe me yours very truly
James D. Forbes

spectators." After a minute and careful inspection of the glacier of the Aar, the ascent of the Jungfrau was resolved upon. Not more than two or three previous attempts had been made, only one of which had been unquestionably successful. The formidable difficulties of the ascent were successfully overcome, and the party reached the summit in safety. The apex of the Jungfrau, in form like a bee-hive, did not afford footing for more than one person at a time. Agassiz and Forbes in turn stood

"On this most steep fantastic pinnacle,
The fretwork of some earthquake, where
The clouds pause to repose themselves in passing by."

On his return to Edinburgh Professor Forbes lectured

mechanism of glaciers as a question of pure physics, and of obtaining precise and quantitative measures as the only basis of accurate induction." It was while examining with Agassiz the glacier of the Aar that Forbes first noticed what he terms the *veined* or *ribboned* structure, which is in the form of thin and delicate blue and whitish bands or strata, traversing the ice in a vertical direction. Professor Tyndall, who has criticised and controverted some of the conclusions of Professor Forbes on the subject of glaciers, says, "His [Forbes's] great merit in connection with it [the veined structure] consists in the significance which he ascribed to the phenomenon when he first observed it, and in the fact of his having proved it to be a constitutional feature of

glaciers in general." This discovery proved of no slight consequence as a step towards the true theory of glaciers, and formed the theme of a paper read to the Royal Society of Edinburgh in December 1841. In this paper, the first he published on the subject, Professor Forbes said he looked forward to another summer to extend his direct observations and experiments; and that meantime he desired to prepare himself for the task by a close analysis of what had been already argued and written on the subject. As the result of this analysis, he found "no single, precise, or quantitative fact respecting glaciers established in a reliable manner;" while the whole weight of the existing scientific authority was ranged on the side of one or other of the two theories of glacier motion—the gravitation or sliding theory of De Saussure, and the dilatation theory of De Charpentier—neither of which, he declares, was worthy of serious consideration. Thus distrusting or rejecting existing theories as to the motion of glaciers, and ignorant of any theory which could account for their structure, Professor Forbes, in June 1842, reached Chamouni, and began a series of observations on the *Mer de Glace*. From time to time, in letters to Professor Jameson, the editor of the Edinburgh "New Philosophical Journal," he reported progress. The end which he proposed to himself was no less than to solve the problem or read the riddle presented by the phenomena of glaciers; and it is interesting to have an account in his own words of the birth of the new or viscous theory as it dawned upon his mind. "I had spent," he says, "some weeks among the glaciers in June and July 1842, without even approximating to a theory either of motion or structure, until at length I began to fear that days and months of incessant observation and patient thought would leave me no wiser about this great problem than when I commenced. But, as is often the process of discovery in complicated questions, when the confusion seems greatest, and the mind is so imbued with the subject that the very multitude of details confounds, and the antagonism of conflicting speculations sets order at defiance, then from some unexpected corner springs up a light, unsought and seemingly casual, but which struggles into more perfect evidence by being dwelt upon, and at last throws a complete illumination over the scattered elements, which appeared undecipherable and unmeaning only because they were dimly seen." The source of the new light was a discovery unexpectedly made, and thus described:—"On the evening of the 24th July (1842), the day following my descent from the Col du Géant, I walked up the hill of Charmoz to a height of 600 or 700 feet above the Montanvert, or 1000 feet above the level of the glacier. The tints of sunset were cast in a glorious manner over the distant mountains, whilst the glacier was thrown into comparative shadow. This condition of half-illumination is far more proper for distinguishing feeble shades of colour, on a very white surface like that of a glacier, than the broad day. Accordingly, while revolving in my mind, during the evening's stroll, the singular problems of the ice-world, my eye was caught by a very peculiar appearance of the surface of the ice, which I was certain I now saw for the first time. It consisted in a series of nearly hyperbolic brownish bands on the glacier, the curves pointing downwards." These *dirt-bands*, as they are termed, Professor Forbes conjectured followed the direction of the veined structure of the ice, which conjecture was afterwards confirmed, and appeared to him, in his elevated position, to resemble floating scum on a partially stagnant stream. From that hour the viscous, or plastic theory, was to him "a conviction and a reality."

The facts ascertained by previous observation and experiment adjusted themselves in harmony with this view of glacier motion.

What, then, according to Professor Forbes, is a glacier? "It is a sluggish stream, moulding itself, notwithstanding the apparent hardness and fragility of the ice, over the inequalities of its bed, and the irregularities of its confining banks, and retaining its coherence throughout, notwithstanding the numerous cracks by which its surface is fissured, in consequence of an inherent plasticity of its substance, which only becomes sensible under intense and long-continued pressure, producing a very slow motion."*

Three papers on glaciers, read before the Royal Society of Edinburgh in February and March 1843, procured for Professor Forbes the award of the Keith prize. The papers were the substance of some of the chapters of his "Travels in the Alps of Savoy," published in the same year, a second edition of which was called for in 1845. The work entitled "Norway and its Glaciers" was the outcome of a visit to that country in 1851. The sublime glacier and mountain scenery of Norway is illustrated by drawings made by the author, and, being successfully lithographed, convey a very just and striking impression. To connect his observations on the glaciers of Switzerland and Savoy with those of Norway, narratives of previous Alpine journeys are reproduced in this volume.

In 1859, induced by the opposition to his views of glacier motion, Professor Forbes collected his scattered papers written on the subject from 1841 to 1858, and published them under the title of "Occasional Papers on the Theory of Glaciers;" his main intention being "to render accessible to all readers the documents by means of which his claims to originality must be decided as to his share in establishing a just theory of a great natural phenomenon." Nor, do we think, can any one peruse this interesting book, as also his reply to Professor Tyndall's remarks in his work on the glaciers of the Alps relating to Rendu's "Théorie des Glaciers," subsequently published, without arriving at the conclusion (whatever modifications may hereafter be admitted) that to Professor Forbes belongs the honour of first establishing on the solid basis of observation the theory of glacier motion.

Professor Tyndall, in a paper read before the Royal Institution in June 1858, while freely commenting on some of the positions of Forbes, thus truthfully speaks of him: "The merits of Forbes must be judged on broad grounds; and the more his labours are compared with those of other observers, the more prominently does his comparative intellectual magnitude come forward. He [Professor Tyndall] would not merely content himself with saying that the book of Professor Forbes was the best book which had been written on the subject. The qualities of mind, the physical culture invested in that excellent work, were such as to make it, in the estimation

* The viscous theory of glaciers, as deduced by observation by the present writer (Professor Forbes), though now very generally accepted, had to struggle with numerous and strongly-urged objections; of which the oftener-repeated was that ice is by its nature a brittle solid, and not sensibly possessed of any viscous or plastic quality. In answer to this, it may be urged that the qualities of solid bodies of vast size, and acted on by stupendous and long-continued forces, cannot be estimated from experiments on a small scale, especially if short and violent; that sealing-wax, pitch, and other similar bodies, mould themselves, with time, to the surfaces on which they lie, even at atmospheric temperatures, and whilst they maintain, at the same time, the quality of excessive brittleness under a blow or a rapid change of form: . . . But, waiving the inferences from all these facts, the main argument in favour of the view now maintained is this, that, admitting the preceding propositions as to the velocity of parts of the glacier (which no one now contests), the quasi-fluid, or viscous motion of the ice of glaciers, is not a theory, but a fact."—Article Glacier in "Encyclopædia Britannica," by Professor Forbes.

of the physical investigator, at least outweigh all other books on the subject taken together."

The three dissertations on the progress of mathematical and physical science, prefixed to the eighth edition of the "Encyclopædia Britannica," were written respectively by the Professors of Natural Philosophy in the University of Edinburgh—Playfair, Leslie, and Forbes. Professor Forbes, in carrying out the plan of his predecessors, treats of the progress of discovery from 1775 to 1850, which period he divides in lesser periods of twenty-five years, each of which he finds characterized by some features peculiar to itself. By selecting the more striking landmarks of progress, and connecting them with the character and position of the more eminent discoverers, he has presented, in a limited space, a clear and comprehensive view of a vast and difficult subject.

We cannot better conclude this sketch than in the words of a recent writer, who thus alludes to the qualities of Principal Forbes as a philosopher and professor: "The scientific researches of Mr. Forbes are characterized by industry and exactness in observing, and judgment in experimenting, caution and sagacity in reasoning from the data of experience, and most careful distinction between hypothesis and fact. In the discharge of his duties as professor, his teaching was always marked by an earnest endeavour to communicate the same characteristics to his students, and to guard them against the dangers of superficial and inaccurate study, and of loose and hasty generalization."

ANECDOTE OF LORD HAILES.

THE following anecdote was related to the Rev. John Campbell, of Kingsland,* by Dr. Walter Buchanan, minister of the Canongate parish, Edinburgh:—

"I was dining," said Dr. Buchanan, "some time ago with a literary party at old Mr. Abercrombie's, of Tullicbody, the father of Sir Ralph Abercrombie, who fell in Egypt. A gentleman present put a question which puzzled the whole company. It was this: 'Supposing all the New Testaments in the world had been destroyed at the end of the third century, could their contents have been recovered from the writings of the three first centuries?' The question was novel to all, and no one even hazarded an answer to the inquiry.

"About two months after this meeting Lord Hailes sent for one of the party, and asked him if he recollected the curious question about the possibility of recovering the contents of the New Testament from the writings of the first three centuries. His friend said he remembered it well, and had often thought of it, without being able to form any opinion or conjecture on the subject.

"Well," said Lord Hailes, "that question quite accorded with the turn or taste of my antiquarian mind. On returning home, as I knew I had all the writers of those centuries, I began immediately to collect them, that I might set to work on the arduous labour as soon as possible." Pointing to a table covered with papers, he said, "There have I been busy for these two months, searching for chapters, half chapters, and sentences of the New Testament, and have marked down what I have found, and where I have found it; so that any persons may examine, and see for themselves. I have actually discovered the whole New Testament from these writings, except seven or eleven verses (I forget

which), which satisfies me that I could discover them also. Now," said he, "here was a way in which God concealed or hid the treasure of his Word, that Julian, and other enemies of Christ, who wished to extirpate the gospel from the world, never would have thought of; and though they had, they never could have effected its destruction." The labour in effecting this feat must have been immense; for the gospels and epistles would not be divided into chapters and verses as they are now."*

We are surprised that this labour of Lord Hailes is not more generally known. In the "Handbook of the Bible," by Dr. Angus, who rarely misses a point in literary and theological argument, reference is thus made to the quotations of the New Testament in the Fathers: "In not less than one hundred and eighty ecclesiastical writers (whose works are still extant) are quotations from the New Testament introduced; and so numerous are they, that from the works of those who flourished before the seventh century the whole text of the New Testament, it has been justly said, might have been recovered, even if the originals had since perished. The experiment was tried by Dr. Bentley, and he confirms the statement."

Another feature of this evidence is referred to by Dr. Angus: "The references of classic authors one to another, though sufficient to establish the antiquity of the works quoted from, form a very inadequate provision for correcting the text of each. They are generally in the way of allusion only to some fact or passage. Even when the references are more pointed, they are generally so loosely made as to be of little critical value. In quotations from the Scriptures the case is entirely different: they are generally made with the utmost care, the very words of the sacred writers being introduced, and forming the subject of lengthened discussion, or of important practical teaching" ("Bible Handbook," ch. 1, § 15).

Among the methods employed by the Emperor Julian and other persecutors to uphold decaying paganism and crush the Christian religion, one was to compel the Christians to give up their sacred books to be burned. Those who were weak enough to obey these edicts were called by the ignominious denomination of Traditores, or traitors, from *tradere*, to deliver up. The insertion of the whole text of the Christian canon in the writings of the early ecclesiastical authors was a providential safeguard against external accidents, and affords a remarkable confirmation of the genuineness and authenticity of the New Testament.

BEHIND THE CURTAIN.

It has fallen to the writer's lot, as a medical man, to become acquainted with the inner life of many grades of people. His first practice as a medical student was chiefly acquired in the back slums of Leather Lane and

* Lord Hailes was just the man to detect Gibbon in any unfairness of argument or quotation, and he did this in criticising the two famous chapters on the Progress of the Christian Religion in "The Decline and Fall." Accordingly, the historian cannot pass him over with the same contemptuous notice with which he treats some of his opponents. In his Autobiography, in referring to the criticisms on his work, he says, "The profession and rank of Sir David Dalrymple (now a Lord of Session) have given a more decent colour to his style. But he criticised each separate passage of the two chapters with the dry minuteness of a special pleader; and as he was always solicitous to make, he may have succeeded sometimes in finding, a flaw. In his 'Annals of Scotland' he has shown himself a diligent collector and an accurate critic." This is quite in Gibbon's style, assuming a sneer against an antagonist even when compelled to admit the force of the reply.

* "Life, Times, and Missionary Enterprises of the Rev. John Campbell, of Kingsland," by Robert Philip, p. 215. Quoted also in "The Lives of the Haldanes," 7th ed., p. 519.

Saffron Hill, a region much of which has since been demolished. Many classes of the lower strata of life made it their domicile, but it was especially noted for pocket-handkerchief thieves and Italian organ-grinders. Justice requires me to state that from those people I always received the greatest attention; and I believe

with more assiduity than profit to me or credit to himself, to conquer a natural awkwardness of which I was supposed to be subject, broke his two legs in one of these stage exploits. A feather bed ought to have been placed for him to fall upon, but it was omitted.

"Are you not exposed to danger sometimes?" I



this will be the testimony of all medical men who have been similarly situated. There were acrobats in that region, too; and I more than once have made it my business to inquire into the manner of education which enables them to perform their extraordinary feats. I was told that gymnasts of all sorts and description must begin their education early. The bones and muscles of children, being soft, can then be moulded and trained to assume positions that no exercise would enable an adult to accomplish; and thus it is that many little bodies become crippled for life, so to speak, in regard to ordinary exercises, merely for the sake of being able to show off in the circus or arena. So far as walking is concerned, stage-dancers, both men and women, must be considered cripples in an anatomical sense. In order to acquire the art of standing on tiptoe, the beautiful arch of the foot must be ruined; and for this reason celebrated dancers always walk unsteadily; to speak plainly, they waddle.

Dancing, however, is the least unnatural exercise of all the gymnastic group. Stage-dancing in large towns is a profession of itself; but in country places the local dancing-master often takes the part of some scared bandit leaping from a rock to escape his pursuers on the stage, or he fills other rôles which are equally dangerous. This fact ought to be impressed on my memory, for, when a child, a certain dancing-master who laboured,

asked one day of a still celebrated clown. "Do you never meet with accidents?" "I should think so," he replied. "If the carpenters and scene-shifters have any spite against us, they take care to serve us out. Sometimes it happens that one has to take a flying leap through a window, but, just as you are going to do it, the carpenter comes over and whispers in your ear, 'What are you going to tip?' If you don't 'tip' him something, you will have an ugly jump." My informant's meaning was obvious. Acrobats making those flying leaps ought either to be caught on a feather bed or in a man's arms; otherwise the result is unpleasant, not to say dangerous. These people are seldom healthy, and very seldom long-lived. The sudden changes of temperature to which they are subject are very prone to give them rheumatism, under the suffering of which their necessities frequently oblige them to perform. The grimaces on the stage of the celebrated clown Grimaldi are well known to have been the results of pain during the latter years of his life.

If the education of stage clowns and acrobats is injurious and dangerous, that of rope-dancers and *trapèze* swingers is far more so.* The risk to life and limb is

* I have heard it stated that the celebrated Leotard learned his dangerous art on a *trapèze* swung over a canal; so that when he fell (which he often did during the years of his novitiate) the water received him, and he swam to the bank.

great. Except in rare instances, the remuneration is small. At a comparatively early age the power of performing their feats is retained with difficulty; and I know of few more painful sights than to see an acrobat stricken with years endeavouring to perform the feats of his youth.

Every now and then some frightful accident or shocking death occurs in the circus or the show-booth. An occurrence of this kind, some years ago, before a vast concourse of people at Aston Park, Birmingham, excited much comment, and elicited from the Queen a dignified rebuke at the degrading use made of a place of public recreation. But no generous or humane feeling touches the mobs who take delight in sensational amusements. At Aston Park the entertainments of the day were scarcely interrupted. The pleasure-seeking crowd and the money-seeking proprietor have no feeling for those behind the curtain, of whom our picture affords a glimpse. The mother of the little dancing sylph is lying in anguish and danger from an accident in the performance. The husband is lingering at her side, after the circus-bell has rung, till summoned by the manager and the shouts of the audience. The incident has been narrated by a master of fiction, but it is the illustration of facts sadly too frequent.

ZOOLOGICAL NOTES.

BY J. K. LORD, F.Z.S.

THE CULTIVATION OF THE SILKWORM.

I.



BOMBYX MORI.

SILKWORMS, to most of us, are only ugly caterpillars, that are kept as mere curiosities in paper trays, fed on mulberry-leaves (when they can be procured, or on lettuce, or any other vegetable the worm is obliging enough to devour in the absence of its favourite food), and that finish their career by spinning themselves a silken wrapper, in a paper cone, pinned against a wall

or hung on a string round the lumber-room. But, if we think for a second that the most costly velvets, satins, silks, and ribbons are the produce of these silk-spinners, we shall to some extent realize the enormous importance of such unprepossessing worms, when considered in a commercial point of view; affording work to hosts of British artisans, and being meat, drink, money, and clothes to thousands who live in sunnier climes. There are two reasons why the silkworm and its culture are, just now, matters of more than ordinary importance. In the first place, a disease has of late proved terribly fatal to the mulberry-worms, in nearly every part of the world where they have been domesticated, so to speak, and that threatens, if not speedily remedied, to utterly exterminate them. In the second place, other species of silk-spinning worms have been recently introduced into France, as well as into other places; and, to some extent, these are replacing the diseased mulberry-worms. But what is of more direct interest is, that a silkworm I shall by-and-by describe has been (although as yet on a limited scale) tried in Essex and at Dangstein, near Petersfield, and the experiments hold out such cheering promise of being signally successful that one really begins to think "sericulture" in England will, in a few years, take its place alongside of agriculture, horticulture, pisciculture, or any other culture.

I propose, therefore, first to consider briefly the history, management, and diseases of the mulberry silkworms, the larvæ of the *Bombyx mori*, as this course will help the reader to a clearer comprehension of the important differences that separate it from the other species, to be afterwards described; in the second place, to give a short account of the silk-spinners that are likely to replace the mulberry-worm, in France and elsewhere; and, lastly, to describe the experiments which are being made at Colchester and Dangstein. I may mention, incidentally, that I have very recently visited Dr. Wallace at Colchester, and am indebted to him for much valuable information, and a view of all his most interesting experiments.

Silk has always been an expensive article. We read of its being valued at its weight in gold at Rome; that Julius Caesar caused the stage of the theatre to be covered with a silken carpet; that the Emperor Tiberius forbade men to wear silk dresses, because he thought it effeminate; and that Aurelian was penurious enough to refuse his empress a silken robe. We read, in Kirby and Spence's "Entomology," that James I, of Scotland, begged from the Earl of Mar the loan of a pair of silk stockings; "for ye would not, sure, that your King should appear as a scrub before strangers."

China seems to have been the country from whence silkworms first found their way into Europe. In about the sixth century of the Christian era two Nestorian monks visited China in the capacity of missionaries, obtained all the requisite information as to the feeding and general treatment of the worms, procured some eggs, and, artfully concealing them in bamboo canes, eventually reached Constantinople, when the eggs were hatched, and the silkworms successfully reared. From this small beginning, silkworms gradually spread throughout Europe; and for six centuries the Greeks of the lower empire monopolized the trade. In the twelfth century the silkworm was cultivated in Sicily; and in the thirteenth century France, Spain, and Italy began the rearing of silkworms, and the manufacture of silken fabrics.

The silkworm moth (*B. mori*) is a whitish moth, with a brownish bar across the upper wings. The larva, or silkworm, is about three inches long when fully grown,

and pale yellow in colour: on the last segment of the body is a horn-like appendage, common to most of the sphinx moths. Its favourite food is the white mulberry (*Morus alba*). It remains about six weeks in the form of a worm, changing its skin four or five times during that period, and, when so occupied, it becomes sickly, and entirely abstains from food. When first emerging from the egg, the tiny silkworm is black, and about the fourth of an inch in length. It begins to gormandize immediately it is born, and gets rid of its first suit of baby-clothes when about eight days have elapsed from its entrance into the world. When fully grown, the grub commences spinning an envelopment of silken fibres, choosing, in the absence of a paper bag, any spot suited to its purpose, and therein makes a silken ball about the size of a pigeon's egg. Thus enwrapped, it changes to a chrysalis, and remains in a torpid condition for about fifteen days. The moths then break their way through the ends of the cocoons, and mate, and the female, having laid her eggs, dies.

Domestication appears to have in some degree produced varieties of *B. mori*, in a similar manner to varieties obtained and perpetuated in domestic animals. Major Bunsky exhibited silk at the Exhibition, produced near Bordeaux, of a pure white colour, spun by silkworms carefully selected and interbred. For example, the three varieties of Sina, Syria, and Novi may be instanced. The Sina produces white silk, very fine in the thread, but weak and wanting in lustre. The Syria are of very large size, and produce a heavy cocoon, but the thread is coarse, and inclining to a greenish tint. The Novi, though small worms, spin a firm fibre, very lustrous and yellow in colour. The cocoon takes about five days for its completion after the worm has commenced spinning.

The silk is a secretion produced from a pair of long glandular tubes, which terminate in a prominent pore or spinnaret, situated on the under-lip. Before their termination the tubes receive another secretion, supplied from smaller glands: this material is for the purpose of gluing together the fine filaments that issue from the two *sericteria*. What appears to the eye to be only a single thread of silk is in reality composed of two or more strands, twisted, and stuck firmly together with this gummy secretion. The quality of the silk spun is in a great degree dependent on the healthful state or otherwise of the two silk-forming tubes, or *sericteria*. When spinning, the worm moves its head from side to side, attaching the silk fibre to the sides of anything it selects, or that it is compelled to spin in, crossing and recrossing the threads, until it finally spins itself into a cone without any aperture. Now it follows that the moth, to make its escape, must break through this network of fibres; and so in reality it does, by first softening the gummy material with a secretion which is specially provided for the purpose. The moth then forces its way out, and, in doing so, spoils the silk for reeling; that is, winding off in a continuous thread. I have been somewhat prolix, but I wish to impress upon my reader's mind, first, that the caterpillar of the *B. mori*, when spinning, interlaces the fibres, and spins a cocoon without any aperture, and that the moth, if allowed to escape, spoils the cocoon.

To avoid this damage to the silk, a few cocoons are selected, and put by for the purpose of obtaining the necessary supply of eggs; the others are then exposed to a temperature of about 202° Fahrenheit, either enclosed in tin tubes, and immersed in boiling water (a requisite precaution to avoid damaging the silk), or placed in an oven and baked: this kills the pupæ that

are enclosed, and saves the cocoons. The average weight of a cocoon is about three and a quarter grains, and should reel off about three hundred yards of fibre.* It is said that sixteen yards of "Gros de Naples" of inferior quality, or fourteen yards if very superior, are made from one pound of reeled silk.

It would occupy too much space to enter fully into the question of preparing the silk for market. Of course the quality of silk depends, in the first place, on the healthful state of the worm; but very much also depends on the process of reeling. The cocoons are first soaked in tepid water, to soften the gum, and the filaments are then wound off, or, as it is termed, "reeled." Silk, on the other hand, that cannot be "reeled" is first carded and then spun, in the same manner as cotton.

The value of skein-silk in a raw state is determined by first winding off 400 ells round a drum that measures exactly one ell in circumference; this skein is then very carefully weighed, and the weight expressed in grains. If the "reeler" has wound five filaments of silk from off the cocoon, the skein of 400 ells ought to weigh two and a half grains, and so on, more or less as a greater or smaller number of threads are reeled together.

Three kinds of raw silk are known in the trade, as "organzine," "trame," and "floss." "Organzine" is used for the warp of silks and stuffs of the best quality. "Trame" is silk of inferior value, very loosely twisted, in order to make it cover better in the weft. "Floss," or "bourre," consists of all the broken silk, carded and spun into "filature," similar to cotton.

The raw silk is skeined or reeled in different ways, depending on the skill and intelligence of the silkworm breeders, and arrives in this country in various kinds of skeins. Here we must leave it; although not the least interesting part of silkworm culture is the wonderful skill man displays in manufacturing the raw material into the matchless fabrics that are produced from the looms of the silk-weavers. Who would ever think a Genoa velvet dress, a costly ribbon, or a satin damask ever formed the wrappers of little worms, spun by themselves as a protection from harm whilst sleeping away the time occupied in passing from the grub to the winged state? The fabled skill of enchanters, fairies, kelpies, and bogies, if mixed together, would never create in the most visionary brain a more wondrous transformation than man, aided by steam and machinery, effects in the manufacture of silken fabrics.

Silk clothing is, to a great extent, beyond the pockets of any but the wealthy, who, when they find the price they have been accustomed to give is nearly double what it once was, simply growl, pay it, and never trouble their heads about the why and wherefore of the rapidly-rising tariff. Men, nor women either for that matter, whatever stations in life they may fill, are not similarly indifferent to the rinderpest, sheep-pox, potato disease, oyster failure, and vine blight; these scourges directly appeal to a man's senses, straight through his pocket to his stomach. We hear him say, "These are matters that must be looked to at once, or the poor will be starved, and the rich ruined." Quite as bad as any of these terrible afflictions have been and still are to us, is the "gattine," or silkworm disease—at present ravaging nearly all the silk-producing countries—to the large section of the

* Taking the silk consumed only in the United Kingdom in a single year at 5,000,000 lbs., the following are the statistics of production:—

Raw silk	5,000,000 lbs.
12 lbs. of cocoons making 1 lb. of raw silk—	60,000,000 cocoons.
30,000 worms to make 1 lb. of cocoons—	18,000,000,000 worms.
1 oz. eggs to 100 lbs. of cocoons—	800,000 ozs. of eggs.
16 lbs. of leaves to 1 lb. of cocoons—	96,000,000 lbs. of leaves.
100 leaves as an average from each mulberry-tree—	9,600,000 trees.

population engaged in producing and manufacturing silk.

In the time of Henry IV, of France, fifteen thousand young mulberry-trees were planted in the grounds which at that time surrounded the Tuileries; the eggs of the mulberry silkworm—"graines," as the French call them—were imported from different places; and, from that time to the present, the cultivation of silk throughout France has been one of her most valuable branches of commerce. France now grows over twenty millions of mulberry-trees, and produces annually about two million pounds weight of silk; besides this, the imports needed to keep a hundred thousand looms at work are at least equal to twice the quantity produced from her soil.

Turn we now to Spain, Greece, China, Italy, Russia, and India, all countries that are as large, and many of them much larger, producers than France; and if we roughly estimate the enormous number of human beings the tiny silkworm keeps in daily employment, we shall awake to the importance and danger of the disease called "gattine."

There are two classes of persons in France that are dependent on each other to some extent: they who keep the worms, feed, rear, and superintend the spinning; and the farmers, who specially cultivate the mulberry-trees, upon the leaves of which the worms can only live so as to supply good silk. Both are usually persons of limited means, and as the worms die away the mulberry-grower finds no sale for his leaves, hence both are reduced to a terrible state of indigence; but what has been most apprehended, and, indeed, may yet happen, is that the mulberry farmer will tear up his plantations, and appropriate the ground to a more profitable crop.

All kinds of hypotheses have been mooted to account for the origin and seat of the disease. Some attribute it to the deterioration of the soil from exhaustion, producing a sickly tree, with flaccid leaves and watery sap. Others assert the worm itself has become weakened from interbreeding; and there are those, again, who lay it to the score of bad ventilation and the effluvia from the fermenting leaves, allowed to accumulate where the worms feed; then there are the believers in atmospheric causes.

If we take into consideration that there are very many artificial conditions under which the worm is necessarily placed—for instance, that it is bred and fed in close rooms, always on plucked, and often on chopped leaves; that the mulberry-tree itself is placed in an unnatural condition by having its foliage plucked, and in never being allowed to produce its fruit; and, further, that the management of the worm is, as a rule, intrusted to persons entirely ignorant of nature's laws and secrets—it is not by any means difficult to imagine that a weakened state of the constitution may be induced, and that fungoid growth might in a worm so weakened find a fitting *nidus* for development, and, thus aided by atmospheric or other causes, produce the fatal "gattine."

The disease generally makes its appearance when the worms have gone through their last transformation and are ready to spin. Then, instead of the promised harvest of cocoons, "gattine" walks in, and sweeps off the spinners by the thousand, leaving the poor breeders to lament a whole year's labour and expense snatched from them in a few hours.

A recent writer thus speaks of the disease as regarding France: "Some persons laugh at the very notion of a return to a healthy state of affairs, and even call it cruel to hold out a hope that the old silkworm will ever again yield a profitable crop; but these pessimists forget

the fact that France has been twice before visited in the same manner within less than two centuries." Then he goes on to state that it appeared in Cévennes in 1688, and lasted till 1710; and reappeared in 1749, when eggs purchased from Italy were worth £1 per ounce, the ordinary price being two francs. The last epidemic lasted seven years, after which time French sericulture assumed its normal condition; hence, he says, "There is no good reason for supposing that the 'gattine' will endure for ever, or even continue much longer."

Be the cause what it may, the "gattine" still spreads, and but one remedy appears likely to check its progress; that is, to get a new species of silkworm. Many experiments were tried, by introducing eggs and worms from distant localities, with varying success. The Société Impériale d'Acclimatation engaged, through its agents in Japan, to supply fifteen thousand cards of seed to the silkworm breeders of France. These eggs, sent from Jeddo, arrived safely. They were sent on "cartons"—thin pieces of cardboard, covered thickly with eggs. Each carton yields, on a rough estimate, from sixty to seventy pounds weight of cocoons, worth about 2s. 6d. per pound in France. Each carton is valued at something like twenty shillings.

As a guarantee that the eggs were genuine, each card was stamped with Japanese characters before the eggs were laid on it. This afforded a grand chance to cheat the poor silkworm breeders. After the Japanese eggs were removed, the cards were bought up, and re-covered with French eggs, and then resold as the genuine article.

The mulberry-worm also suffers from another disease, called "muscardino" in France, "calcinetto" in Italy. A whitish fungus (*Botrytis basiana*) grows round the segments of the worm's body, and covers it with a white efflorescence that soon kills it. Though not nearly so fatal as "gattine," still a great many worms fall victims to this vegetable parasite. The worm attacked acquires a mealy look; hence the name for the disease (*calcinetto*, chalk). The only plan is to at once burn all the worms showing any symptoms of the fungoid growth: the fungus spreads with awful rapidity if allowed to disseminate its germs through the atmosphere.

In order to replace the loss caused by the "gattine" disease, an able naturalist, M. Guérin-Meneville, was commissioned by the French Government to inquire about other species. The result of a long and interesting series of experiments (far too lengthy to be described) is, that two new species have been acclimatized, and many more are likely to prove valuable to the silk culturists, in addition to the long-known *B. mori*. The two species that are at present found to answer so well are *B. Ricini*, so called because it feeds on the castor-oil plant (*Ricinus communis*), and *B. cynthia*, from China, better known as the ailanthus silkworm moth; but it is more than likely these two are varieties of the same species.

Then comes *B. mylitta*, from Northern India, from which is produced the tough and everlasting "Tusseh silk;" and another from China, *B. Pernyi*: both feeders on oak leaves. *B. Atlas* is the largest known species; and from Cayenne comes *B. hesperus*, that feeds on the *café diable*. Senegal produces another silk-spinner, *B. bauhinia*, which feeds on the jujube-tree.

From Japan we get perhaps the most magnificent insect of the tribe, the oak silkworm (*B. yamamai*). The moth measures six inches to the points of the wings, and is beautifully shaded with yellow, orange, and red. The larva, or caterpillar, is a bright green, mixed with blue and yellow, and marked in its latter stages of

growth with small silver-like spots along its sides. These worms are likely, it is said by several who have bred them in this country, to answer well, as they feed entirely on the leaves of the oak. The cocoon it spins is very large, and the quality of its silk nearly equal to that of the mulberry-worm. Experiments are being tried with the oak-worms this summer, and the probable success likely to attend the trial of acclimatization will then be better known. I believe the worm is considered the property of the Emperor in Japan, and the punishment of death is inflicted on any person known to sell it, or allow it to be taken out of the country.

The cecropia moth (*Attacus cecropia*), one of the nocturnal moths, is found from the Canadas to the Mexican Gulf. Its wings, when expanded, measure six inches in breadth, and are covered with dusky brown scales, and marked with four kidney-shaped red spots and a whitish band. It makes its appearance in the Southern States in May, and the female deposits her white somewhat oval eggs on apple, cherry, and plum trees. The worms feed on the leaves of either. The caterpillar measures from three to four inches in length, is of a light green colour, and has coral-red warts, studded with stiff bristles, covering its body. It remains on the trees till August, then descends to search for a spot fitted for it to spin its cocoon in. They generally spin between two twigs. The cocoon is very tough, brown in colour, about three and a half inches long, and one wide. The *inside* of this outer parchment-like covering is thickly lined with soft, strong silk, which can be readily reeled. These cocoons, in the open air, will stand a temperature of 10° Fahrenheit without sustaining any injury. When the moth is ready to escape, it throws out a caustic liquid from its mouth, which destroys the fibres of the silk, and thus enables it to break through the end of its tough prison, out of which it creeps damp and crumpled. By constantly moving the antennæ and wings, it soon dries, and is then ready for an aerial excursion. It has been ascertained that twenty threads of cecropia silk, twisted, will sustain an ounce more weight than the same number of fibres obtained from the common silkworm. This silk has been woven into stockings that are found to wash equal to linen.

Another silk-producing worm is the larva of the polypheme moth (*Attacus polyphemus*). The moth is very like the cecropia, differing only in the markings on the wings. The larva is bluish green, covered with orange-coloured and purple warts. It feeds on the elm and lime-trees. To spin its cocoon, the worm draws together several leaves of the tree with its silken threads, and, when enclosed within them, weaves an oval cocoon about two inches long, which is very strong, and falls to the ground with the leaves, where it remains until the following July. When the moth issues from her prison, she lays her eggs on the branches of an elm or lime tree, and dies. The silk is of the same character and quality as that of the cecropia.

Then there is another caterpillar, that feeds on the hickory-trees—the larva of the luna moth (*Attacus luna*); and a fourth on the leaves of the sassafras, the larva of the promethea moth (*A. promethea*); but, as the same remarks apply to these two as to the cecropia, they need not be repeated. It may be as well to mention that the promethea caterpillar fastens the leaves with a silken cord to the twig where it spins the cocoon, and thus prevents it from falling to the ground when the leaves are shed. We have to consider in detail by far the most important; viz., the alanthus silkworm, the larva of *Bombyx cynthia*, which we reserve for another paper.

Varieties.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The meeting for 1866, at Nottingham, commences on the 22nd August, under the Presidency of W. R. Grove, Esq., Q.C., F.R.S., etc., who will deliver the opening address in the theatre.

ASCENTS OF MONT BLANC.—From the year 1786 to the end of 1865 the total number of all the ascensions of Mont Blanc was 293, of which 187 were carried out by Englishmen, 39 by Frenchmen and Savoyards, 21 by Americans, 19 by Germans, and 9 by Swiss. The first ascension took place in 1786, by Jacob Balmat and Dr. Piccard; the second and third by H. B. de Saussure. Marie Paradis, of Chamouny, was the first female ascender, in 1809; Mlle. Henrietta d'Angeville the second, in 1838. In the year 1865 Mont Blanc was climbed by 35 persons, among whom were four ladies.—*Bulletin de la Société de Géographie de Paris*.

DR. ROBERT KAYE GREVILLE.—Another of a distinguished band of botanists has passed away, Dr. Greville, of Edinburgh, Dr. Harvey, and Dr. Lindley having not long survived Sir W. T. Hooker. Besides being a learned botanist, especially in the cryptogamic flora, and an accomplished artist, Dr. Greville took a leading part in all benevolent and philanthropic objects in his adopted city. He was born, in 1794, at Bishop Auckland, in Durham. Like Professor E. Forbes, he was intended for the medical profession, but circumstances enabled him to carry out his early devotion to natural history. His degree of LL.D. was from the University of Glasgow. In the pleasant excursions to the Scottish Highlands thirty years ago, under Professor Robert Graham, Dr. Greville was a zealous botanical collector, and also a keen angler, like his friend and brother naturalist James Wilson. Of these excursions, a genial account will be found in the life of James Wilson, by Dr. James Hamilton.

MR. PEABODY AT HOME.—A correspondent of a New York paper, writing from Georgetown, Massachusetts, says, "Mr. Peabody has been living with his sister, Mrs. Daniels, who resides in this village. Georgetown is situated north-east of Boston, a distance of twenty-eight miles, and on the Boston and Maine Railroad. The village is small, probably containing not over a thousand inhabitants. Mrs. Daniels' residence is a medium-sized double frame house, painted white, with green shutters, and stands back about twelve feet from the main street, on which it fronts. Here Mr. Peabody proposes to make his home during the summer. Everything about the place is plain, but neat and clean; and in making this his choice, aside from the claims of affection, we see the simplicity of the taste of the man."

DR. JOHNSON ON THE ATONEMENT.—The following is part of a passage dictated by Dr. Johnson to Mr. Boswell:—"Whatever difficulty there may be in the conception of vicarious punishments, it is an opinion which has had possession of mankind in all ages. There is no nation that has not used the practice of sacrifices. Whoever, therefore, denies the propriety of vicarious punishments, holds an opinion which the sentiments and practice of mankind have contradicted from the beginning of the world. The great sacrifice for the sins of mankind was offered at the death of the Messiah, who is called in Scripture the Lamb of God that taketh away the sins of the world. To judge of the reasonableness of the scheme of redemption, it must be considered as necessary to the government of the universe that God should make known his perpetual and irreconcilable detestation of moral evil. He might, indeed, punish, and punish only the offenders; but, as the end of punishment is not revenge of crimes, but propagation of virtue, it was more becoming the Divine clemency to find another manner of proceeding, less destructive to man, and at least equally powerful to promote goodness. The end of punishment is to reclaim and warn. That punishment will both reclaim and warn which shows evidently such abhorrence of sin in God as may deter us from it, or strike us with dread of vengeance when we have committed it. This is effected by vicarious punishment. Nothing could more testify the opposition between the nature of God and moral evil, or more amply display his justice, to men and angels, to all orders and successions of beings, than that it was necessary for the highest and purest nature, even for Divinity itself, to pacify the demands of vengeance by a painful death; of which the natural effect will be, that when justice is appeased there is a proper place for the exercise of mercy."